

WHAT IS CLAIMED IS:

1. A way predictor comprising:

5 a decoder configured to decode an indication of a first address that is to access a cache, the decoder configured to select a set responsive to the indication of the first address;

10 a memory coupled to the decoder, wherein the memory is configured to output a plurality of values from a set of storage locations in response to the decoder selecting the set, wherein each of the plurality of values corresponds to a different way of the cache; and

15 a circuit coupled to receive the plurality of values and a first value corresponding to the first address, wherein the circuit is configured to generate a way prediction for the cache responsive to the plurality of values and the first value.

20 2. The way predictor as recited in claim 1 wherein the circuit comprises a plurality of comparators, wherein each comparator of the plurality of comparators is configured to compare a respective one of the plurality of values to the first value, and wherein the circuit is configured to generate the way prediction predicting a first way of the cache for which the corresponding value of the plurality of values matches the first value.

25 3. The way predictor as recited in claim 2 wherein the circuit, if none of the plurality of values matches the first value, is configured to assert an early miss signal.

4. The way predictor as recited in claim 1 wherein each of the plurality of values comprises a portion of a tag identifying a corresponding cache line in the cache, the

portion excluding at least one bit of the tag.

5 5. The way predictor as recited in claim 1 wherein each of the plurality of values is derived from at least a portion of the indication of the address identifying a corresponding cache line.

6. The way predictor as recited in claim 5 wherein each of the plurality of values comprises a portion of one or more address operands used to generate the address.

10 7. The way predictor as recited in claim 5 wherein at least one bit of one of the plurality of values is a logical combination of two or more bits of the address.

8. The way predictor as recited in claim 5 wherein at least one bit of one of the plurality of values is a logical combination of two or more bits of one or more address operands
15 used to generate the address.

9. The way predictor as recited in claim 1 wherein the indication of the first address comprises at least a portion of the first address.

20 10. The way predictor as recited in claim 1 wherein the indication of the first address comprises one or more address operands used to generate the first address.

11. The way predictor as recited in claim 1 wherein, if the way prediction is incorrect, the cache is configured to replace a cache line in the way indicated by the way prediction
25 with a missing cache line corresponding to the first address.

12. The way predictor as recited in claim 11 wherein, if no way prediction is generated and a cache miss results for the first address, the cache is configured to use a replacement algorithm to select the cache line to be replaced with the missing cache line.

13. A method comprising:

decoding an indication of a first address that is to access a cache to select a set;

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outputting a plurality of values from a set of storage locations in a memory in
response to the set being selected, wherein each of the plurality of values
corresponds to a different way of the cache; and

10 generating a way prediction for the cache responsive to the plurality of values and
a first value corresponding to the first address.

14. The method as recited in claim 13 wherein the generating comprises comparing each
of the plurality of values to the first value, and wherein the way prediction predicts a first
15 way of the cache for which the corresponding value of the plurality of values matches the
first value.

15. The method as recited in claim 14 further comprising, if none of the plurality of
values matches the first value, indicating a miss.

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16. The method as recited in claim 13 wherein each of the plurality of values comprises a
portion of a tag identifying a corresponding cache line in the cache, the portion excluding
at least one bit of the tag.

25 17. The method as recited in claim 13 wherein each of the plurality of values is derived
from at least a portion of the indication of the address identifying a corresponding cache
line.

18. The method as recited in claim 17 wherein each of the plurality of values comprises a

portion of one or more address operands used to generate the address.

19. The method as recited in claim 17 wherein a bit of each of the plurality of values is a logical combination of two or more bits of the address.

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20. The method as recited in claim 17 wherein a bit of each of the plurality of values is a logical combination of two or more bits of one or more address operands used to generate the address.

10 21. The method as recited in claim 13 further comprising, if the way prediction is incorrect, replacing a cache line in the cache in the way indicated by the way prediction with a missing cache line corresponding to the first address.

22. The method as recited in claim 21 further comprising, if no way prediction is
15 generated and a cache miss results for the first address, using a replacement algorithm to select the cache line to be replaced with the missing cache line.

23. An apparatus comprising:

20 a way predictor comprising:

a decoder configured to decode an indication of a first address that is to
access a cache, the decoder configured to select a set responsive to
the indication of the first address;

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a memory coupled to the decoder, wherein the memory is configured to
output a plurality of values from a set of storage locations in
response to the decoder selecting the set, wherein each of the
plurality of values corresponds to a different way of the cache; and

5 a first circuit coupled to receive the plurality of values and a first value
corresponding to the first address, wherein the first circuit is
configured to generate a way prediction for the cache responsive to
the plurality of values and the first value; and

10 a data cache data memory coupled to the way predictor, wherein the data cache
data memory is arranged into a plurality of ways, and wherein the data
cache data memory is configured to output data from a predicted way of
the plurality of ways, wherein the predicted way is identified by the way
prediction, and wherein the data cache data memory includes a second
circuit configured to reduce power consumption attributable to one or
more non-predicted ways of the plurality of ways.

15 24. The apparatus as recited in claim 23 further comprising a data cache tag memory
configured to output a tag from the predicted way and to not output tags from the one or
more non-predicted ways.

20 25. The apparatus as recited in claim 23 wherein the second circuit is configured to
generate separate wordlines for each of the plurality of ways in the data cache data
memory, and wherein the second circuit is configured to activate a first wordline to the
predicted way and to not activate word lines to the non-predicted ways responsive to the
way prediction.

25 26. The apparatus as recited in claim 25 wherein the second circuit includes column
multiplexor circuitry coupled to the plurality of ways and configured to select the output
of the predicted way as input to a sense amplifier circuit, wherein the column multiplexor
circuitry is controlled by the way prediction.

27. The apparatus as recited in claim 23 wherein the second circuit includes column multiplexor circuitry coupled to the plurality of ways and configured to select the output of the predicted way as input to a sense amplifier circuit, wherein the column multiplexor circuitry is controlled by the way prediction.

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28. The apparatus as recited in claim 23 wherein the second circuit comprises a plurality of sense amplifier circuits, wherein each of the plurality of sense amplifier circuits is coupled to a respective one of the plurality of ways, and wherein each of the plurality of sense amplifier circuits includes an enable input that is controlled by the way prediction.

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